



Natural Gas Role in Fuel Diversity and Reducing California Emissions

Presentation to California Energy Commission and
California Air Resources Board

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By Michael Eaves

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Emissions



Natural Gas Firsts - HD

- ◆ Achieve 4 grams (NOX) when standard 5
- ◆ Achieve 2-2.5 gram when standard 4
- ◆ Responsible for CARB creation of optional certification levels below required standards
- ◆ First to certify to 1.8 grams – 1.5grams – 1.2 grams
- ◆ First to achieve 0.01 gram PM – the 2007 std
- ◆ Industry on schedule to deliver 2010 standards in 2007 (NOX 0.2 gram – PM 0.01 gram)

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Natural Gas Firsts - LD

- ◆ First to achieve ULEV emissions
- ◆ Created the need for SULEV standards
- ◆ Introduced concept of ILEV (no evaporative emissions)
- ◆ First vehicles to achieve SULEV certification



Natural Gas Impact

- ◆ Downward pressure on CARB and EPA standards
- ◆ Forcing diesel and gasoline to respond
- ◆ Natural gas achieving largest net benefit in emission reductions by by addressing high fuel use fleets both HD and LD



Standards to Accommodate Fuel

- ♦ No relaxation in adopted/proposed standards to accommodate fuels
 - ♦ CARB Transit Rule
- ♦ CARB adoption of Fleet Rules for SCAQMD that achieve 2010 emissions in 2007



Fuel Quality



CARB NG Fuel Specifications

- ♦ NGV industry advocating throughout '90s to broaden commercial fuel spec for NG
- ♦ Recommendation in 1998 for MN73 std statewide
- ♦ Allow NGV development in central coast and SJV
- ♦ No detrimental impact on emissions
- ♦ Potential impact on older vehicles

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Issues with Engines

- ♦ Older HD engines couldn't accommodate lower MN fuel
 - ♦ Survivability not emissions the issue
- ♦ Newer technology can accommodate down to MN65 (world engines)
- ♦ Legacy fleet – what do you do with them?
 - ♦ Retrofit to accommodate fuel
 - ♦ Replace
 - ♦ Cost



Supply

- ♦ California gas production was the issue in '90s
- ♦ Today the issue is quality of potential LNG imports
- ♦ Solutions available to accommodate new supplies and protect large legacy fleet exist

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Impact of Fuel Quality on Emissions



CAVTC Study on Fuel Quality

- ♦ Test 7 HD vehicles
- ♦ Test 4 Fuels
 - ♦ CARB Spec fuel
 - ♦ High C3+
 - ♦ High C3+ & Inerts
 - ♦ High Ethane
- ♦ Test 3 driving cycles
- ♦ 3 Tests/cycle/fuel/vehicle

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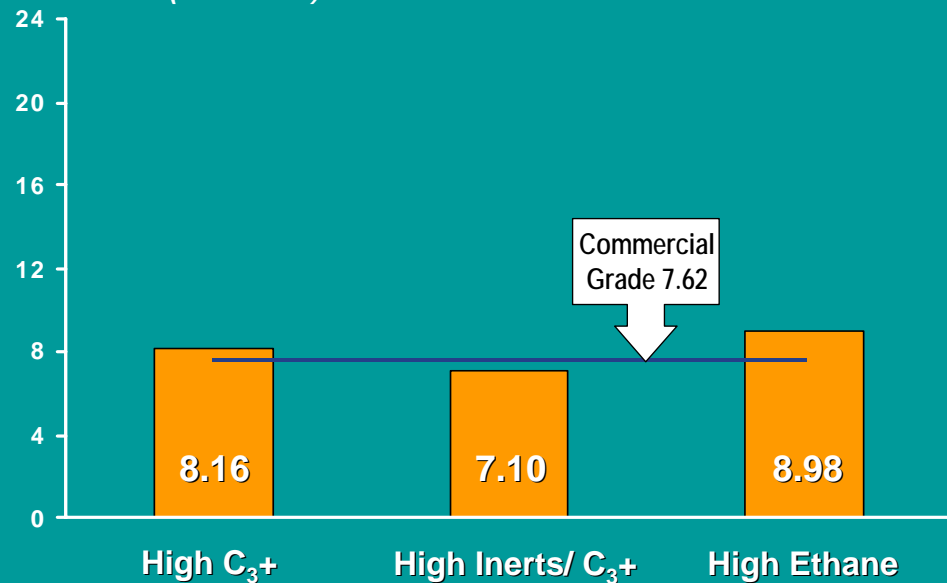


NO_x Emissions Closed Loop System

Test Vehicle #1:

**School Bus
Engine: MY '97**

Emissions (Grams/Mi)



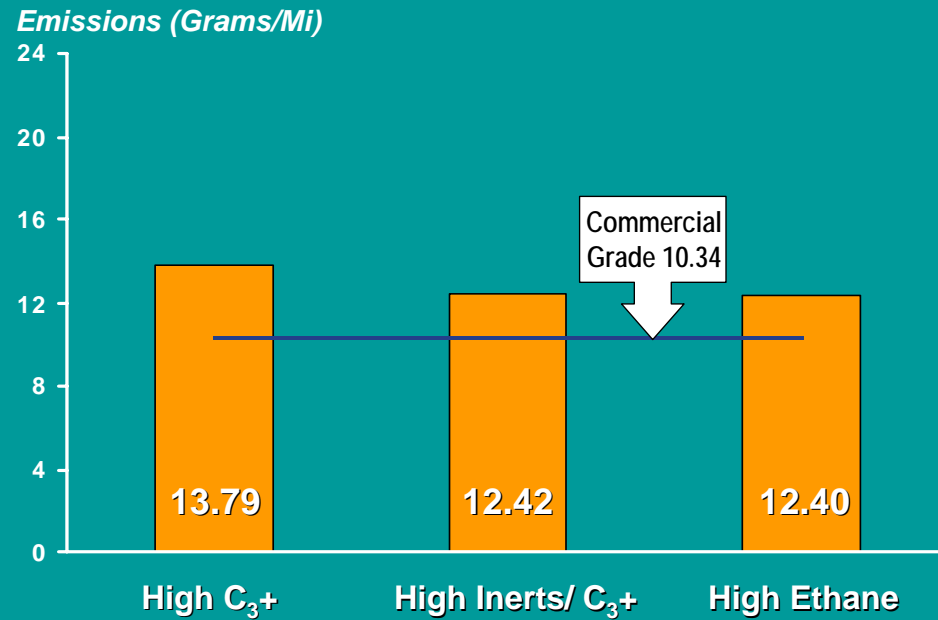
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NO_x Emissions Closed Loop System

Test Vehicle #2:

**School Bus
Engine: MY '99**



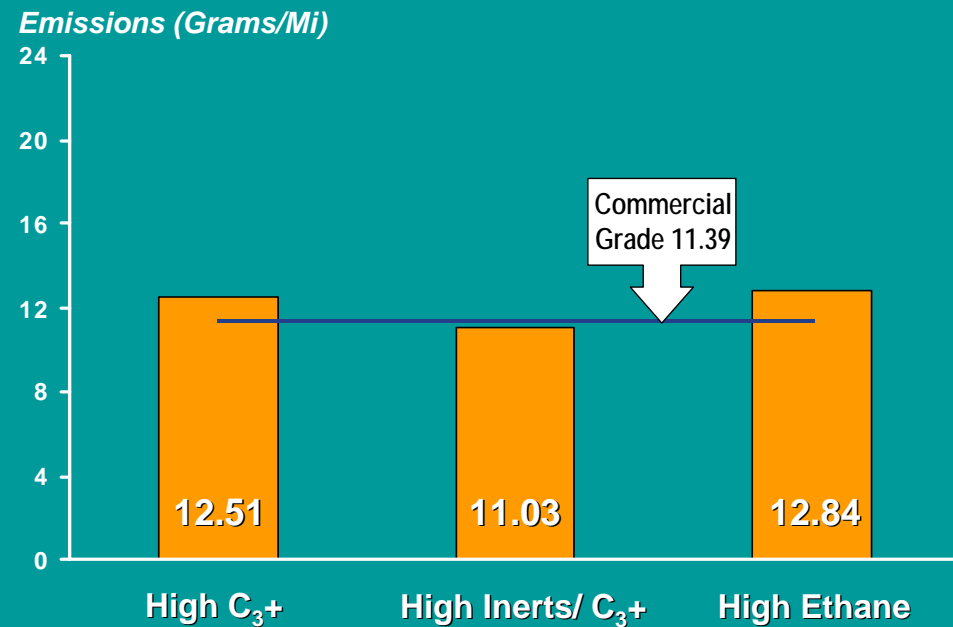
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NO_x Emissions Closed Loop System

Test Vehicle #3:

**School Bus
Engine: MY '96**



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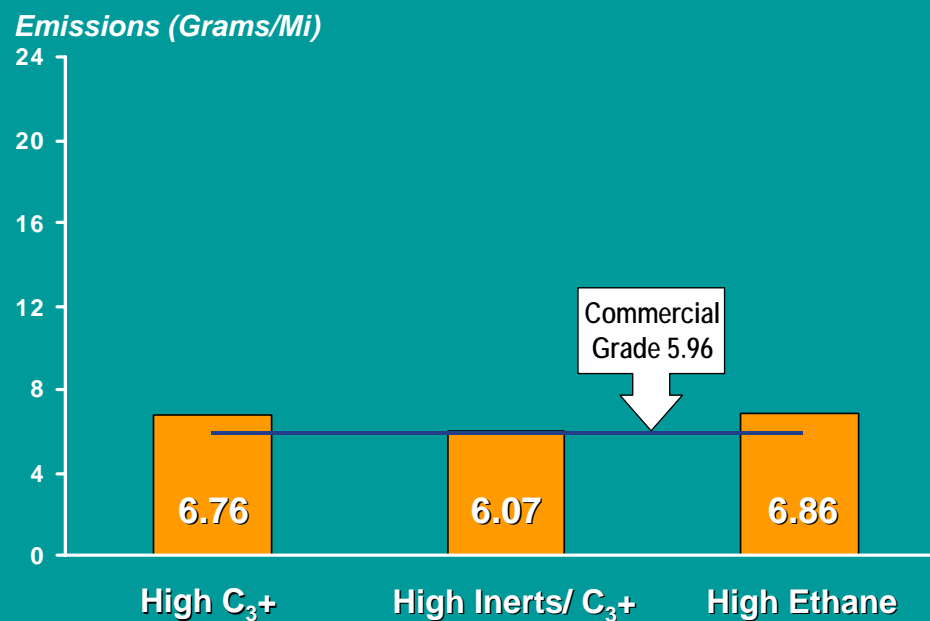


NO_x Emissions Closed Loop System

Test Vehicle #4:

Crew Truck

Engine: MY '99



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Conclusion of Fuel Composition

- ♦ Low emissions can be achieved with broader fuel composition
- ♦ Emissions don't have to be sacrificed
- ♦ NGV industry still advocates broader fuel composition spec with 2010 emissions target
- ♦ NGV industry working on HCNG blends to further reduce emissions from legacy fleet

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Supply Constraints

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Natural Gas Growth in California

- ♦ LNG terminals or other pipeline solutions will be needed to address California growth in all market segments
- ♦ NG has potential to displace 1-2 billion gallon/yr petroleum by 2030
- ♦ Current NGV market 0.4% of total California send out of NG
- ♦ 2 billion gallon/yr NGV market equivalent to 5-6% of today's NG

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Barriers



Scale

- ♦ All alt fuels at huge disadvantage when compared to entrenched competitor (who doesn't want competition)
- ♦ Needs state policies and incentives to promote (Renewable Portfolio Standard)
- ♦ SB 757 (Kehoe) – AB 1007 (Pavley)
- ♦ Need to educate public on why policies and assistance needed Consistency across the board with state agencies, regulatory bodies

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NG Deployment Strategy Model – for all Alt Fuels

- ♦ Identify right market niches to penetrate
- ♦ Consolidate gains
- ♦ Expand opportunities to other market segments
- ♦ Need consistent and long term state policies
- ♦ Can't/shouldn't rely on help from petroleum industry

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